| TRANSMITTAL OF APPEAL BRIEF (Large Entity)	Docket No. US000335

In Re Application Of: **Krishnamachari et al.**

Application No. 09/741,724	Filing Date December 19, 2000	Examiner Do, Chat C.	Customer No. 28581	Group Art Unit 2124	Confirmation No. 7516

Invention:

APPROXIMATE INVERSE DISCRETE COSINE TRANSFORM FOR SCALABLE COMPUTATION COMPLEXITY VIDEO AND STILL IMAGE DECODING

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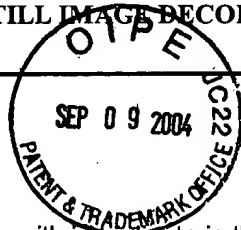
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Dated: **September 7, 2004**

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re application of: Santhana
Krishnamachari et al.

Examiner: Do, Chat C.

Serial No.: 09/741,724

Group Art Unit: 2124

Filed: December 19, 2000

Date: September 7, 2004

For: APPROXIMATE INVERSE DISCRETE
COSINE TRANSFORM FOR SCALABLE
COMPUTATION COMPLEXITY VIDEO
AND STILL IMAGE DECODING

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BRIEF OF APPELLANT

This is an appeal from the Office action mailed on April 7, 2004 finally rejecting claims

1, 3-15, and 17-27, all the claims pending in the application. This Brief is accompanied by the

requisite fees set forth in 37 CFR 1.17(c). Authorization is hereby given for any additional fees

due and owing in connection with this Brief or for any overpayment credit to be charged to

Deposit Account No. 50-2061.

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REAL PARTY IN INTEREST

Philips Electronics North America Corporation, is the real party in interest in the present

appeal.

RELATED APPEALS AND INTERFERENCES

Philips Electronics North America Corporation, the real party in interest in the above-captioned application, has no related applications currently on appeal or involved in an interference.

STATUS OF CLAIMS

Claims 1, 3-15, and 17-27 stand finally rejected.

STATUS OF AMENDMENTS

Amendments to claims 1, 15, and 27 proposed in the reply filed on June 9, 2004 were considered but not entered.

SUMMARY OF THE INVENTION

The present invention is an approximate inverse discrete cosine transform (IDCT) for digital video and still image decoding as respectively used in MPEG and JPEG compression/decompression techniques. The approximate IDCT of the present invention utilizes an algorithmic process whose complexity scales to the computational resources available in the microprocessor of the decoder at any given time.

Referring to the block diagram of FIG. 1 in conjunction with page 5, line 7 through page 6, line 9 of the specification, the approximate IDCT of the present invention provides complexity scaling in accordance with the following process. First, the maximum number of available computational units is observed for each multiplication to be performed by the IDCT (step 10).

Next, it is determined whether the maximum number of computational units available (the maximum computational complexity available) for each multiplication is sufficient (step 12). If the maximum number of available computational units is sufficient, the multiplication is performed (step 14). If the maximum number of available computational units is insufficient, then multiplications are replaced by one or more shift/add-operations, shift/substract-operations, or a shift-operation, the exact number and type of such operations being dependent upon the maximum number of computational units required therefore (step 16).

If it is determined that the number of computational units required for performing multiple shift/add-operations, shift/subtract-operations, or a shift-operation is greater than or equal to that required for the multiplication, the multiplication is approximated with an abbreviated shift-operation. Approximation is typically performed when the multiplication is by a value that is not a single power of two. Such a multiplication may involve a shift-operation comprised of two or more shifts, the results of which are then added or subtracted. The abbreviated shift-operation of the present invention neglects one or more of these shifts and additions/subtractions to scale the complexity of the IDCT to the available computational units.

ISSUES

There are two issues in this appeal.

The first issue is whether claims 1, 3-15, and 17-27 are indefinite under 35 USC 112, second paragraph, for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The second issue is whether claim 27 is unpatentable under 35 USC 103(a) over U.S. Patent 5,999,958 to Chen *et al.* (Chen) in view of U.S. Patent 4,849,922 to Riolfo.

GROUPING OF CLAIMS

Regarding the first issue, claims 1, 3-15 and 17-27 stand or fall together.

Regarding the second issue, claim 27 stands or falls alone.

ARGUMENT

I. REJECTION UNDER 35 USC 112, SECOND PARAGRAPH

The first issue is whether claims 1, 3-17, and 19-21 are indefinite under 35 USC 112, second paragraph, for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. In particular, the examiner states that with respect to the (claim 1) limitation "acquiring the maximum available quantity of computational resource units" it is unclear whether the maximum available quantity of computational resource units are defined by an operator as an allowed processing time or are defined automatically by the system as available resources.

The inquiry for definiteness under 35 USC 112, second paragraph is whether the claims set out and circumscribe a particular subject matter with a reasonable degree of clarity and particularity. Definiteness of claim language should be analyzed in view of 1) the content of the particular application disclosure; 2) the teachings of the prior art; and 3) the claim interpretation that would be given by one possessing the ordinary level of skill in the pertinent art at the time the invention was made. The examiner must consider the claim as a whole to determine whether the claim apprises one of ordinary skill in the art of its scope and, therefore, serves the notice function required by 35 USC 112, second paragraph, by providing a clear warning to others as to

what constitutes infringement of the patent. See, for example, Solomon v. Kimberly-Clark Corp., 216 F.3d 1372, 1379, 55 USPQ 1279, 1283 (Fed. Cir. 2000).

It is respectfully submitted that one of ordinary skill in the art would be apprised of the scope of claims 1, 3-15, and 17-27, and in particular, what is meant by the limitation "acquiring maximum available quantities of computational resource units." Indeed, page 5, lines 2-3 of applicant's specification describes that the computational resource units are the computational resources available in the microprocessor of the decoder at any given time. Further, page 1, lines 23-24 of applicant's specification describes a few non-limiting examples of what these computational resource units may be, e.g., CPU cycles, cache, memory size, memory bandwidth, coprocessor load, and the like. Moreover, it is likely that one of ordinary skill in the art would recognize that the maximum available quantities of computational resource units could also be defined by an operator.

In view of the above, it is respectfully submitted that one of ordinary skill in the art would easily understand what is meant by the limitation "acquiring maximum available quantities of computational resource units" and therefore, be apprised of the scope of claims 1, 3-15, and 17-27.

It should be noted that this rejection was not raised until the final office action mailed on April 7, 2004. In response to this rejection, applicant filed a reply on June 9, 2004 amending each of claims 1, 15 and 27 to require that the resource units be defined by the system. In the advisory action mailed on July 15, 2004, the examiner denied entry of these amendments because they were believed to be insufficient because "the amended independent claims still do not clearly disclose to what and how the maximum units are obtained by the system."

It is respectfully submitted that it was improper for the examiner to not enter the amendments filed on June 9, 2004 because at the very least, these amendments placed the application in better form for appeal by materially reducing or simplifying the issues for appeal. Certainly applicant's reply filed on June 9, 2004 obviated the rejection under 35 USC 112, second paragraph, as applicant responded to the examiner's objection regarding this feature by further limiting the scope of the computational resource units to those defined by the system. This amendment was one of the two possible amendments suggested by the examiner to overcome this rejection.

The examiner's comments in the advisory action mailed on July 15, 2004, (i.e., "the amended independent claims still do not clearly disclose to what and how the maximum units are obtained by the system") are inappropriate because they go beyond the 35 USC 112, second paragraph issue raised by the examiner in the final Office Action of April 7, 2004. In particular, the examiner now appears to be stating that the claims are too broad and therefore are indefinite. However, breadth of a claim is not to be equated with indefiniteness. In re Miller, 441, F.2d 689, 169 USPQ 597 (CCPA 1971). Furthermore, the examiner should have raised this issue in the final rejection of April 7, 2004.

In view of the foregoing, claims 1, 3-15, and 17-27 are not indefinite under 35 USC 112, second paragraph.

II. REJECTION UNDER 35 USC 103(a)

The second issue is whether claim 27 is unpatentable under 35 USC 103(a) over Chen in view of Riolfo.

A claimed invention is *prima facie* obvious when three basic criteria are met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine teachings. *See In re Jones,* 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992); *In re Fine,* 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988). Second, there must be a reasonable expectation of success. *See In re Merck & Co., Inc.,* 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). Third, the prior art reference or combined references must teach or suggest all the claim limitations. *See In re Royka,* 490 F. 2d 981, 180 USPQ 580 (CCPA 1974).

It is respectfully submitted that Chen in view of Riolfo do not arrive at the present invention because their combined teachings do not teach or suggest all the limitations of claim 27. Specifically, Chen in view of Riolfo do not teach or suggest a decoder which scales video and still image decoding complexity with available computational resources, comprising an approximate IDCT that performs a selected data multiplication by performing either the data multiplication or by performing a shift-operation, depending upon the number of system defined maximum quantity of the computational resource units which are available, as required by claim 27.

In contrast, Chen discloses a device for computing an IDCT, which is based solely <u>on</u> <u>adders</u>. Thus, Chen does not disclose a decoder which is capable of scaling video and still image decoding computational complexity with available computational resources, as alleged by the examiner.

Riolfo fails to cure the deficiencies of Chen, as Riolfo merely discloses a circuit for computing a DCT. Riolfo does not disclose, teach or suggest a decoder for computing an IDCT which scales video and still image decoding complexity with available computational resources.

Accordingly, Chen in view of Riolfo <u>do not</u> teach or suggest a decoder which comprises an approximate IDCT that performs a selected data multiplication by <u>performing either the data multiplication or a shift-operation</u>, depending upon the number of system defined maximum quantity of the computational resource units which are available, as required by claim 27.
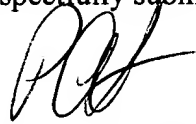
Hence, it is respectfully submitted that the combined teachings of Chen in view of Riolfo fail to establish a *prima facie* case of obviousness of the invention.

In view of the foregoing, claim 27 is patentable under 35 USC §103(a) over Chen in view of Riolfo.

CONCLUSION

It has been shown that the claimed invention complies with 35 USC 112, second paragraph and distinguishes over the express and implied teachings of the prior art cited of record in the application. Hence, appellant respectfully requests that the Board reverse the examiner and direct that the application proceed to issue.

Respectfully submitted,

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APPENDIX A
CLAIMS IN APPEAL

1. (Previously Presented) A method of scaling image and video processing computational complexity in accordance with maximum available quantities of computational resource units, the method comprising the steps of:

    (a) performing a plurality of data multiplications which processes digital image and video data, each data multiplication having a data dependent value multiplied by data independent value, the performance of each data multiplication requiring a predetermined quantity of computational resource units;

    (b) selecting one of the data multiplications;

    (c) acquiring the maximum available quantity of computational resource units for performing the selected multiplication;

    (d) determining whether the maximum quantity of computational resource units available for the selected multiplication is sufficient for performing same;

    (e) performing the selected multiplication if the maximum quantity of computational resource units available for the selected multiplication is sufficient for performing same; or

    (f) selecting a shift-operation using the data independent value associated with the selected multiplication that requires a quantity of computational resource units which is less than the predetermined quantity of computational resource units required for performing the selected multiplication; and

    (g) performing the selected multiplication with the selected shift-operation.

2. (Canceled)

3. (Original) The method according to claim 1, wherein the data independent value is a single power of two and the selected shift-operation includes a single shift made according to the single power of two.

4. (Original) The method according to claim 1, wherein the data independent value is a sum of powers of two and the selected shift-operation includes at least one shift-operation corresponding to one of the powers of the sum.

5. (Original) The method according to claim 4, wherein the at least one shift-operation approximates the selected multiplication.

6. (Original) The method according to claim 4, wherein the selected shift-operation includes at least two shift-operations the results of which are added, the at least two shift-operations corresponding to two of the powers of the sum.

7. (Original) The method according to claim 4, wherein the power of the sum corresponding to the at least one shift-operation has a value which is nearest to the data independent value.

8. (Original) The method according to claim 1, wherein the data independent value is a difference of powers of two and the selected shift-operation includes at least one shift-operation corresponding to one of the powers of the difference.

9. (Original) The method according to claim 8, wherein the at least one shift-operation approximates the selected multiplication.

10. (Original) The method according to claim 8, wherein the power of the difference corresponding to the at least one shift-operation has a value which is nearest to the data independent value.

11. (Original) The method according to claim 8, wherein the selected shift-operation includes at least two shift-operations the results of which are subtracted, the at least two shift-operations corresponding to two of the powers of the difference.

12. (Original) The method according to claim 1, wherein the plurality of data multiplications defines an inverse discrete cosine transform.

13. (Original) The method according to claim 1, wherein the plurality of data multiplications form a multiple stage network having an input and an output, the selected multiplication is selected from a stage of the network which is nearest the output thereof.

14. (Original) The method according to claim 1, wherein the image and video processing includes image and video decoding and the digital image and video data is encoded digital image and video data.

15. (Previously Presented) A method of approximating an inverse discrete cosine transform to scale its decoding computational complexity in accordance with maximum available quantities of computational resource units, the transform decoding encoded digital image and video data by performing a plurality of data multiplications, each data multiplication having a data dependent value multiplied by data independent value, the performance of each data multiplication by the transform requiring a predetermined quantity of computational resource units, the method comprising the steps of:

(a)   selecting one of the data multiplications;

(b)   acquiring the maximum available quantity of computational resource units for performing the selected multiplication;

(c)   determining whether the maximum quantity of computational resource units available for the selected multiplication is sufficient for performing same;

(d)   performing the selected multiplication if the maximum quantity of computational resource units available for the selected multiplication is sufficient for performing same; or

(e)   selecting a shift-operation using the data independent value associated with the selected multiplication that requires a quantity of computational resource units which is less than the predetermined quantity of computational resource units required for performing the selected multiplication; and

(f)   performing the selected multiplication with the selected shift-operation.

16. (Canceled)

17. (Original) The method according to claim 15, wherein the data independent value is a single power of two and the shift-operation includes a single shift made according to the single power of two.

18. (Original) The method according to claim 15, wherein the data independent value is a sum of powers of two and the selected shift-operation includes at least one shift-operation corresponding to one of the powers of the sum.

19. (Original) The method according to claim 18, wherein the at least one shift-operation approximates the selected multiplication.

20. (Original) The method according to claim 18, wherein the power of the sum corresponding to the at least one shift-operation has a value which is nearest to the data independent value.

21. (Original) The method according to claim 18, wherein the selected shift-operation includes at least two shift-operations the results of which are added, the at least two shift-operations corresponding to two of the powers of the sum.

22. (Original) The method according to claim 15, wherein the data independent value is a difference of powers of two and the selected shift-operation includes at least one shift-operation corresponding to one of the powers of the difference.

23. (Original) The method according to claim 22, wherein the at least one shift-operation approximates the selected multiplication.

24. (Original) The method according to claim 22, wherein the power of the difference corresponding to the at least one shift-operation has a value which is nearest to the data independent value.

25. (Original) The method according to claim 22, wherein the selected shift-operation includes at least two shift-operations the results of which are subtracted, the at least two shift-operations corresponding to two of the powers of the difference.

26. (Original) The method according to claim 15, wherein the transform forms a multiple stage network having an input and an output, the selected multiplication is selected from a stage of the network which is nearest the output thereof.

27. (Previously Presented) A decoder which scales video and still image decoding computational complexity with available computational resources, the decoder comprising:

    a variable length decoder;

    an inverse quantizer which dequantizes signals received from the variable length decoder; and

    an approximate inverse discrete cosine transform that scales decoding computational complexity in accordance with maximum available quantities of computational resource units, wherein the transform decodes encoded digital image and video data by performing a plurality of

data multiplications, each data multiplication having a data dependent value multiplied by a data independent value, the performance of each data multiplication by the transform requiring a predetermined quantity of computational resource units, the transform performing a selected one of the data multiplications if a determined maximum quantity of the computational resource units available for the selected data multiplication is sufficient for performing same, or the transform performing the selected data multiplication with a shift-operation that requires a quantity of computational resource units which is less than is required for performing the selected one data multiplication.

28. (Canceled)